

Synthesis of novel biochar substrate from harvested *Cyperus alternifolius* and its applicable potential for fluoride removal from river waters in artificial floating beds

Chaoguang Gu^{a,b}, Shuang Song^{a,b}, Shuyi Chu^c, Jibo Xiao^{d,*}, Ronald W Thring^{d,e},
Lingzhou Cui^d

^aCollege of Environment, Zhejiang University of Technology, Hangzhou 310014, China

^bCollaborative Innovation Center of Yangtze River Delta Region Green Pharmaceuticals, Zhejiang University of Technology, Hangzhou 310014, China

^cWenzhou Vocational College of Science and Technology, Wenzhou 325000, China

^dCollege of Life and Environmental Science, Wenzhou University, Wenzhou 325035, China, email: jbxiao@126.com (J. Xiao)

^eEnvironmental Science and Engineering, University of Northern British Columbia, Prince George, British Columbia, Canada

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ABSTRACT

Fe-impregnated biochar (FeBC) substrates were prepared from harvested *Cyperus alternifolius* at pyrolysis temperatures of 400°C, 600°C, and 800°C. Surfaces of obtained biochars were characterized by scanning electron micrograph, Brunauer-Emmett-Teller, and Fourier transform infrared spectroscopy. The performance of FeBC to remove fluoride from aqueous solution was investigated under varying conditions of pH, adsorbent dosage, and contact time. The potential of fluoride removal from polluted waters in artificial floating beds with FeBC as substrates was studied. The results showed that fluoride removal was not affected significantly by the variation of pH and remained above 90% over the entire pH range of 2.0–10.0. The pseudo-second-order model was found to best describe the adsorption kinetics. The maximum adsorption capacity values were 13.624, 14.144, and 14.706 mg g⁻¹ under temperatures of 293, 303, and 313 K, respectively. The artificial floating beds with FeBC-rooted *Cyperus alternifolius* could remove 81.6% F at day 10 for initial fluoride concentration of 5 mg L⁻¹. Thus, FeBC may be a feasible alternative in the removal of fluoride from contaminated waters.

Keywords: Fluoride; Biochar; Fe-impregnated; Substrate; Adsorption; Artificial floating bed

* Corresponding author.